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## Nitrogen fertilization of dryland winter wheat in eastern Colorado

R.J. Goos, D.G. Westfall and A.E. Ludwick<sup>1</sup>

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### Quick Facts

Nitrogen deficiencies in winter wheat are common in eastern Colorado, especially in northeastern Colorado.

Grain protein history is a good indicator of nitrogen need. Fertilize fields with nitrogen if protein contents are consistently below 11.1 percent.

A soil testing program is the only accurate way to predict nitrogen needs for a future crop.

Apply nitrogen before the joint stage of growth if yields are to be increased.

All common nitrogen carriers are equally effective at equal nitrogen rates if some simple precautions are followed.

Nitrogen fertilization has not been shown to reduce yields at reasonable rates.

Research conducted over a four-year period in eastern Colorado show that about 50 percent of the 35 sites tested were nitrogen deficient and gave a significant grain yield response to added nitrogen. These yield responses ranged from 3 to 30 bushels per acre depending on rainfall and the residual nitrate level of the soil. Nitrogen deficiencies have been found throughout eastern Colorado although deficiencies were most commonly observed north of Interstate 70 where about 60 percent of the sites tested responded to nitrogen fertilizer.

### Fields Needing Fertilization

A simple "rule of thumb" can be used to evaluate the nitrogen fertility of the soil. This is covered in more detail in Service in Action 0.555, *Grain protein content as an indicator of nitrogen fertilizer needs in winter wheat in eastern Colorado*. Briefly, if a field usually produces grain protein levels of less than 11.1 percent the soil probably is deficient in nitrogen. Fields producing grain in the 11.1 percent to 12.0 percent range may have a nitrogen deficiency, while fields above 12.0 percent protein

It has been traditionally thought that dryland winter wheat does not require added nitrogen fertilizer when grown in a summer fallow cropping system. In years past when fields were younger, adequate available nitrogen (nitrate) was released during fallow to meet the nitrogen requirement of the following crop. However, the nitrogen released in present fallow periods is generally insufficient to meet the need of today's wheat crop. Years of cropping, fallowing and erosion have depleted the organic matter reserves of many soils. This soil nitrogen depletion problem is compounded by the fact that wheat yields (crop demands for available nitrogen) are higher than before due to higher yielding varieties, improved cultural practices that conserve more moisture, etc.

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This information provided by:

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1. R.J. Goos, North Dakota State University professor, agronomy; D.G. Westfall, Colorado State University Cooperative Extension professor, agronomy, and A.E. Ludwick, western district director, Potash Phosphate Institute, Davis, California. 10/93. ©Colorado State University Cooperative Extension. 1994. For more information, contact your county Cooperative Extension office.

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probably have an adequate nitrogen supply. It requires about 20 to 30 lbs N/A to increase the protein content by one percentage point. This also will happen even if the protein content is already in the 12 percent range.

## How Much Nitrogen?

The amount of fertilizer nitrogen needed depends on three main factors: residual profile nitrate level, soil organic matter content and yield potential. Nitrogen fertilizer requirements from 10 to 75 lbs N/A have been observed in eastern Colorado. The most accurate method of predicting future needs is through soil sampling and soil testing. Many fertilizer dealers offer sampling services, or growers can take their own samples, following instructions listed in Service in Action 0.500, *Soil sampling--the key to a quality fertilizer recommendation*.

The Colorado State University Soil Testing Laboratory gives precise soil analyses and unbiased fertilizer recommendations for wheat, which are based on field research conducted in Colorado. A sampling depth to 2 feet is preferred, although N recommendations can be made with 0 to 1-foot samples. Soil samples should be air-dried immediately (within a few hours) after collection. Never send wet samples to the soil testing laboratory. The analytical results will be erroneous because of changes in the nitrate-nitrogen levels that occur when the temperature of field moist soils is raised. Revised fertilizer recommendations for dryland wheat are shown in Table 1.

**Table 1: Nitrogen fertilizer recommendations for dryland winter wheat in eastern Colorado with a yield goal of 35 bushels/acre.**

Residual nitrate-nitrogen level, ppm		Percent soil organic matter		
Depth		0-1.0	1.1-2.0	> 2.0
0-1 ft.	0-2 ft.	N fertilizer recommendation-lbs/A		
0-3	0-5	75	50	35
4-6	6-9	55	30	15
7-9	10-12	35	10	0
10-12	13-15	15	0	0
> 12	> 15	0	0	0

To convert to metrics: 1 bushel = .035 cubic meter; 1 acre = .4 hectare; 1 foot = .3 meter; 1 pound = .45 kilogram

To adjust N recommendation for yield goal different than 35 bu, add or subtract 25 lbs N per 10 bu difference.

soil testing program take essentially no risk that their yields will be reduced by overfertilization.

## Applying Nitrogen

Nitrogen can be applied anytime from the beginning of the fallow period up to the late tillering/pre-jointing stage of growth. March 15 to April 1 is the approximate cutoff date for nitrogen fertilization. Nitrogen applied after jointing will increase grain protein, but not yield. Many farmers in northeastern Colorado prefer preplant applications of anhydrous ammonia. In southeastern Colorado many farmers prefer to topdress a solid or solution nitrogen source in the spring so that the result of winter kill and available water can be evaluated before investing in fertilizer. Both methods are acceptable if the nitrogen is applied before the joint stage of growth in the spring.

## Which Nitrogen is Best?

All of the common nitrogen carriers (ammonium nitrate, anhydrous ammonia, urea, urea-ammonium nitrate solution, etc.) are equally effective at equal nitrogen rates if some simple precautions are followed. Anhydrous ammonia should not be injected into very dry soil, as losses may occur, and it should be applied several days before planting to avoid plant toxicity problems. Urea and urea-containing solutions should not be topdressed on the soil in hot weather. Volatilization losses can occur if the soil temperatures are high. No losses of urea have been observed in research trials when the urea was topdressed on wheat in early March to early April. Surface applications of urea fertilizers should not be made on fallow fields with heavy amount of prostrate stubble on the surface.

## More About Fertilizing Wheat

To find out more information concerning fertilizing winter wheat contact your county Cooperative Extension agent to obtain Service in Action 0.500, *Soil sampling--the key to a quality fertilizer recommendation*; 0.501, *Soil testing for fertilizer recommendations--what's behind a reliable test*; 0.502, *Soil test explanation*; and 0.555, *Grain protein content as an indicator of nitrogen fertilizer needs in winter wheat in eastern Colorado*.

## Will Nitrogen Reduce Yields?

Research conducted in eastern Colorado has shown that yield reductions due to nitrogen fertilization rarely occur. Yield losses have been observed only at nitrogen rates that were very high (50 to 90 lbs N/A above that needed for maximum yield). Farmers who follow a good